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# PATENT SPECIFICATION

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## (54) FLOOR PANEL AND ELEVATED FLOOR ASSEMBLY USING SAME

(71) We, TATE ARCHITECTURAL PRODUCTS, INC., a Corporation organized and existing under the laws of the State of Maryland United States of America, of, Box 349C, 7510 Montevideo Road, Jessup, State of Maryland, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to floor panels and to elevated floor assemblies using the same.

Modern computer installations employing advanced computer equipment require a carefully planned and completely coordinated environment. Today's sophisticated equipment must be provided with temperature and humidity control, air filtration, traffic and noise restrictions, and a wide variety of other flexible facilities for the machines and their operators. Provision must be made for future expansion, in the form of new or modified equipment.

For these and other reasons, many modern computer installations are provided with what are commonly referred to as raised or elevated floors. These floors generally take the form of removable rectangular floor panels or tiles supported in spaced relation above a suitable sub-floor by a metal lattice of criss-crossing grids and supporting columns. Conduits, such as electrical cabling, air conditioning equipment, and the like, pass between the sub-floor and the floor to the computer circuits and associated equipment. In some instances, the space between the two floors may be used as a plenum to supply conditioning air to various parts of the room. In all cases the removability of the panels provides great flexibility in making it possible to add additional cabling or to service

the computer equipment as the need arises.

A floor panel and elevated floor assembly using the same, particularly suitable for modern computer installations, has been earlier described in the United States Patent 3,681,882 published on August 8, 1972. According to that Patent, the customary floor tile covering for the panels and the accompanying lateral trim edge is replaced by a flexible and preferably at least slightly resilient floor covering material which not only extends over the top surface of the floor panels, but also along the edges and for a short distance along the underside of each panel. The floor covering may take the form of a carpet with sufficient resiliency that the abutting edges of adjacent panels form an air seal to define a plenum beneath the raised floor. The wrap-around floor covering material is moreover in contact with a metal support structure of the elevated floor assembly, the structure being connected at spaced points to a central earthing system, so that all static electricity is conducted to earth.

It is an aim of the present invention to improve the known floor panel and elevated floor assembly using the same, especially with a view to providing improved electrical contact between the floor panels and the underlying support structure as well as between adjacent panels.

According to the invention, there is provided a floor panel comprising a core having top and bottom surfaces joined by at least three edges, a flexible one-piece continuous carpet overlying said top surface and having portions overlying the edges of said core and terminating that of said bottom surface, said carpet being permanently adhesively secured to the core along said edges and said top surface thereof, and a sheet metal plate underlying said core and secured thereto, said plate

having upturned flanges overlying the carpet portions overlying the core edges and being in contact with the outer faces of said overlying carpet portions to facilitate disposal of static electricity.

There is also provided an elevated floor assembly comprising a subfloor, a support structure spaced above said subfloor, and a plurality of floor panels supported by said support structure in spaced relation to and above said sub-floor, each panel comprising a core having top and bottom surfaces joined by at least three edges, a flexible one-piece continuous carpet overlying said top surface and having portions overlying the edges of said core and terminating short of said bottom surface, said carpet being permanently adhesively secured to the core along said edges and said top surface thereof, and a sheet metal plate underlying said core and secured thereto, said plate, having upturned flanges overlying the carpet portions overlying the core edges and being in contact with the outer faces of said overlying carpet portions to facilitate disposal of static electricity, adjacent plates of the respective panels of said assembly being electrically coupled.

In order that the invention may be more fully understood, it will now be described with reference to the following drawings, wherein:

Figure 1 is a perspective view of a portion of a raised floor assembly constructed in accordance with the aforesaid United States Patent 3,681,882;

Figure 2 is a partial cross section through the raised floor assembly or system of Figure 1;

Figure 3 is an enlarged view of a support pedestal, grid, and abutting panel junction in the system of Figures 1 and 2;

Figure 4A is a perspective view showing the top and two side edges of one of the identical floor panels indicated in Figures 1 to 3;

Figure 4B is a similar perspective view showing the bottom and other two side edges of the panel of Figure 4A;

Figure 5 is a perspective view of a modified floor panel disclosed in the aforesaid United States Patent 3,681,882, with parts cut away to show the carpet attached directly to the core;

Figure 6 is a partial elevational view corresponding to that of Figure 3 showing a portion of a raised floor assembly in which the metal gridwork is omitted, as also previously disclosed;

Figure 7 is a partial cross section through a modified floor panel constructed in accordance with the aforesaid United States Patent 3,681,882;

Figure 8 is a partial cross section

through a further modified floor panel constructed in accordance with the aforesaid United States Patent 3,681,882;

Figure 9 is a view similar to Figures 3 and 6 showing a still further previously disclosed modified elevated floor assembly;

Figure 10 is a view similar to Figure 1 and illustrates the improved form of elevated floor assembly using floor panels constructed in accordance with the present invention;

Figure 11 is an enlarged vertical cross sectional view of a support pedestal, and abutting panel junction in the assembly illustrated in Figure 10;

Figures 12, 16 and 17 are exploded perspective views of various forms of support posts or pedestals for use with the assembly illustrated in Figure 10;

Figures 13 and 14 are enlarged exploded cross-sectional views illustrating the manner of fabricating the improved floor panel used in the assembly illustrated in Figure 10;

Figure 15 is a vertical cross sectional view of the completed floor panel used in the assembly illustrated in Figure 10; and,

Figures 16 and 17 show two additional forms of support pedestals for use in the assembly illustrated in Figure 10.

Referring to the drawings, a portion of a known raised floor assembly constructed in accordance with the United States Patent 3,681,882 is generally indicated at 10 in Figure 1. The assembly is illustrated as under construction in a room including walls 12 and 14 and a sub-floor 16. Adhesively secured or otherwise suitably attached to the subfloor are a plurality of pedestals 18 in the form of adjustable metal column supports for a plurality of identical rectangular floor panels 20. Some of the panels 20 in Figure 1 are omitted to show the underlying support pedestals 18 and the overall metal grid generally indicated at 22. The grid 22 comprises longitudinal and transverse grid members or stringers 24 and 26 supported by the heads or caps of each of the pedestals 18. Pedestals 18 are placed on 24 inch centers and the panels 20 are square and approximately 2 feet on each side.

Referring in particular to Figures 2 and 3, pedestals 18 each comprise a base 28 welded, brazed, or otherwise suitably secured as indicated at 30 in Figure 3 to one end of a threaded metal stud 32. The upper end of stud 32 is received in the hollow lower end of metal tube 34. The upper end of this tube is again welded, brazed, or otherwise suitably attached as at 36 to the underside of a pedestal cap or head 38. The telescoping relationship between stud 32 and tube 34 may be adjusted by a pair of metal leveling nuts

40 and 42 to vary and adjust the height of the pedestal 18. Base 28 of the pedestal is preferably attached to subfloor 16 with adhesive but may be secured in any desired manner. Likewise, cap 38 of the pedestal 5 may be attached to the stringers 24 and 26 in any conventional manner. The stringers 24 and 26 are all of equal length, i.e., nominally 2 feet, and are slid over suitable 10 projections on the head of the pedestal.

Resting on the stringers 24 and 26 are the known floor panels 20. Each panel is identical in construction and each is of a square configuration having a side of 24 15 inches and is about 1 to 2 inches thick. As best seen in Figure 3, each of the panels comprises a core 50 approximately 1 inch thick and made of suitable material, such as a high density particle board, i.e., com- 20 pressed wood particles. Overlying the upper and lower surfaces of core 50 are flat rectangular sheets 52 and 54 made of galvanized steel. Steel sheets 52 and 54 are secured to the opposite surfaces of core 50 25 by a suitable adhesive layer (not shown). Finally, the top or walking surface of the panels 20 is formed by a layer 56 of conventional all wool looped pile floor carpeting. The carpet extends over the edge of 30 the panel as indicated at 58 and for a short distance along the panel bottom as indicated at 60. The carpet 56 extends integrally over all four edges of the panel and includes a bottom portion 60 along 35 each of these four edges, in all instances integral as illustrated in Figures 4A and 4B. The carpet is secured to the metal plates and to the edges of the core by suitable adhesive (not shown).

40 The resiliency of the covering material at the abutting edges of adjacent panels 58 automatically compensates for variations in core sections 50 from panel to panel such that a variety of core materials may be 45 used. For example, Figure 6 shows a construction in which the floor panels 70 are of identical construction to the panels 20 previously described but with the exception that the cores 72 are made of lightweight 50 and preferably expanded concrete. Because of the increased strength afforded by the concrete cores, the pedestals 18, which in this case are provided with a flat cap or head 74, directly support abutting panels 55 70.

The modified panel 80 shown in partial cross section in Figure 7 is in all respects 60 identical to the panels 70 of Figure 6 with the exception that the concrete core 82 has embedded in it interconnected longitudinal and transverse strands 84 and 86 of metal reinforcing rods to provide added strength to the core and overall panel. The still 65 further modified panel 90 shown in partial cross section in Figure 8 is identical to the

panels previously described but the core 92 thereof is formed of several interconnected wood plies to form a plywood core of increased strength.

In Figure 9, the panels 20' are in all re- 70 spects identical to the panels 20 previously described with the exception that each of the edges has a very noticeable taper, as indicated at 94, from the top to the bottom 75 surface of the panel. The panels previously described are all made with a slight taper from top to bottom to reduce the friction encountered when the panels are inserted and particularly when they are removed 80 from adjacent panels. The slight taper is indicated generally at 88 in Figures 7 and 8. In Figure 9, the taper 94 is much more pronounced to provide clearance for a rib 96 formed along the top edge of the string- 85 ers, such as the stringer 26' illustrated. The pedestal 18' is also modified to include an outwardly flaring head 98 suitably apertured to pass four screws (only one of which is indicated at 100) for securing a bracket or nut 102 to the end of the 90 stringer 26'. To attach the stringer to the head, the stringer is slipped into position with its lower flanges resting on head 98 to beneath nut 102. Screw 100 is then 95 tightened to clamp the stringer by the nut to the top of the pedestal head. The other three stringers forming a corner junction for the assembly of Figure 9 are similarly secured to the pedestal 18'. An earth wire 100 104 is provided with a conductive eyelet 106 electrically connected to the metal stringer 26' by a second screw 108 and nut 110, screw 108 passing through a suitable aperture provided in the stringer. The other end of earth wire 104 is connected to 105 the central building earth system and one such wire 104 is preferably provided for each 1000 square feet of elevated floor area.

The covering material extending along 110 the four edges at 60 on the underside of the known panel provides a cushioning effect when the panel rests on the head 74 of Figure 6 or on the stringers, such as the stringer 26 of Figure 3, so that there is no 115 direct metal-to-metal contact between the stringer or head and the metal sheet 54. However, by virtue of the wrap-around floor covering being in contact with the metal under-structure, through lower edge 120 60 and the metal under structure being connected at appropriate points to a central earthing system as illustrated at 104 in Figure 9, static electricity in the walking surface of each panel tends to go to earth. 125 This is an important consideration for many computer installations since static electricity discharge is considered harmful to the low voltage electronic equipment employed in these installations and can 130

cause discomfort to personnel.

Referring now to the embodiment of the floor panel according to the invention, by means of which improved electrical contact is provided between each panel and its underlying support structure as well as between adjacent panels, there is illustrated in Figure 10 another form of elevated floor assembly generally indicated 120 and, as in Figure 1, is illustrated as under construction in a room including walls 122 and 124 and a subfloor 126. Disposed on floor 126 are a plurality of support posts or pedestals 128 for supporting a plurality of identical rectangular floor panels 130 at their corner junctures. In the simplest form of support for the panels 130 in this assembly, the support posts or pedestals 128 are in the form of wooden blocks, each being provided with four upstanding pins 132 for engagement in openings or apertures 134 formed on the underside of the cores 136 of panels 130. The pedestals 128 are placed on 24 inch centers and the panels 130 are square and approximately 2 feet on each side.

Supported by pedestals 128 is the improved form of floor panel 130 having a core 136 approximately 1 inch thick and made of like materials as the known core 50 earlier described herein. As noted previously, each core 136 is provided with an aperture 134 adjacent each corner for receiving an upstanding pin 132 of a support pedestal 128. The top or walking surface of panels 130 is provided with a layer 138 of flexible one-piece continuous carpet. The carpet layer 138 is secured along the top surface of core 136 and along its side edges by a suitable adhesive. In contrast to the earlier described known panel constructions, the carpet terminates short of the bottom surface of cores 136 along its side edges, and a sheet metal plate or pan 140 is adhesively or otherwise secured along the bottom surface of core 136. Pan 140 has lateral flanges projecting outwardly beyond the edges of core 136 and which flanges 142, in the finished form of panel 130, project upwardly to overlie the carpet edges secured along the edges of the core 136. That is, the flanges 142 lie in engagement with the pile of the carpet and as noted hereinafter are in contact therewith to facilitate dispersal of static electricity.

Referring to Figures 12-15, the manner of forming the improved panels 130 is illustrated. Referring particularly to Figure 13, the top surface of core 136 and the undersurface of layer 138 are provided with suitable adhesive and laminated one to the other with the edges of the carpet folded down and laminated to the edges of the core. Thereafter, the pan, which has

been previously cut and formed such that the flanges 142 extend laterally at a shallow angle, i.e., about 45°, is similarly secured to the undersurface of core 136. Adhesive is not, however, applied to the inside faces of upturned flanges 142. Once the core 136 and pan 140 are laminated, the assembly is rolled or formed to bend the flanges 142 upwardly into overlying and engaged relation with the carpet edges overlying the edges of core 136. Thus, the carpet edges are compressed bringing the metal pan into contact with the outer faces of the carpet. Openings 144 are provided through the metal pan 140 adjacent each corner thereof, either in conjunction with the formation of apertures 134 in cores 136 after assembly of the core and metal pan, or prior to assembly thereof with the openings 144 lying in a registry with previously formed apertures 134.

To install the elevated floor assembly in which the improved panel 130 is used, the pedestals 128 are placed along the subfloor 126 at appropriate locations and the panels are set over the pedestals. Particularly, the apertures 144 and 134 at the corners of each panel 130 receive a corner pin 132 on pedestal 128 and it will be appreciated that each pedestal supports the four-corner juncture of the panels 130 thereby interlocking the panels one to the other. An important feature of this elevated floor assembly resides in the electrical coupling of adjacent panels when interlocked one to the other by the pedestals. Static electricity buildup is thereby avoided as the charge dissipates over this wider area. Also, flanges 142 of adjacent panels lie in electrical contact one with the other, thus increasing the effectiveness of the electrical contact between adjacent panels. To further enhance the dissipation of static electricity and also to provide a resilient support for panels 130, a pad 146 (Figure 12) of resilient material having an electrically conductive upper surface may be provided. The pad 146 has openings 148 adjacent its corners for receiving the upstanding pins 132 of the underlying pedestal 128 whereby the corner edges of pans 140 are supported along the upper face of pad 146. Consequently, the pans 140 line in electrical contact one with the other through the conductive coating on the pad which also serves to provide a resilient support for the panels 130.

Referring to Figures 16 and 17, there are disclosed two additional forms of support pedestals for supporting the elevated floor assembly illustrated in Figure 10. In Figure 16, the pedestal 128a comprises an inverted channel shaped member 150 having outwardly projecting flanges 152 along its lower end for supporting the pedestal on

subfloor 126. The base 154 of the pedestal carries a plurality of upstanding pins 132a about which are received resilient washer pads 156. Pedestal 128a is utilized in a manner similar to that of pedestal 128 of Figures 10 to 12. The resilient washer pads 156 are preferably formed of an electrically conductive material whereby electrical contact is maintained between the metal pan 140 and the metal pedestal 128a, while a cushioning effect is also provided between these parts.

Referring now to Figure 17, there is disclosed a pedestal 128b which is preferably formed of extruded aluminum in a cruciform shape. The walls 158 of the cruciform 128b terminate in sleeve portions 160, which at their upper ends, are adapted to receive pins 132b. Pins 132b may be formed of metal thus providing electrical contact between the metal pan 140 and the aluminum pedestal 128b.

It will be appreciated that the improved panels 130 described in connection with the elevated floor assembly illustrated in Figure 10 may also be utilized in the known floor assemblies described herein instead of the floor panels 20, 20', 70, 80 or 90. Also, the entire assembly, as shown in Figure 10, is preferably earthed. Furthermore, the use of pins in this latter assembly interlocks the improved panels 130 one to the other forcing them into electrical contact one with the other and with the pedestal block itself thereby maintaining electrical contact throughout the entire elevated floor assembly and also forming a substantial air seal whereby the area between the subflooring and the panels can be utilized as an air plenum.

The flexible one piece continuous carpet, which extends over the top of the panel and over the side edges, makes possible the use of a variety of panel core materials since the flexibility of the carpet, particularly about the abutting edges of adjacent floor panels, automatically compensates for variation in size of the core and makes possible the use of core materials which can not be economically manufactured to close dimensional tolerances. In addition to the more conventional fiberboard and pressed wood particle board panels, the present invention makes possible the use of other core material, such as gypsum board, lightweight and preferably expanded concrete, either reinforced or not reinforced, and laminated wood panelling or plywood. In the improved panel 130, the carpet may be a conventional pile carpet made of wool, nylon, or any of the other conventional carpet materials. Since stronger core materials, such as the newer lightweight concrete, may be employed, the floor panels, according to the present in-

vention, may be provided with cores which permit the elimination of the conventional metal gridwork of elevated floor assemblies, so that the panels can be directly supported on pedestals as illustrated in Figures 6 and 10.

#### WHAT WE CLAIM IS:—

1. A floor panel comprising a core having top and bottom surface joined by at least three edges, a flexible one-piece continuous carpet overlying said top surface and having portions overlying the edges of said core and terminating shaft of said bottom surface, said carpet being permanently adhesively secured to the core along said edges and said top surface thereof, and a sheet metal plate underlying said core and secured thereto, said plate having upturned flanges overlying the carpet portions overlying the core edges and being in contact with the outer faces of said overlying carpet portions to facilitate disposal of static electricity.

2. An elevated floor assembly comprising a sub-floor, a support structure spaced about said subfloor, and a plurality of floor panels supported by said support structure in spaced relation to and above said subfloor, each panel comprising a core having top and bottom surfaces joined by at least three edges, a flexible one-piece continuous carpet overlying said top surface and having portions overlying the edges of said core and terminating shaft of said bottom surface, said carpet being permanently adhesively secured to the core along said edges and said top surface thereof, and a sheet metal plate underlying said core and secured thereto, said plate having upturned flanges overlying the carpet portions overlying the core edges and being in contact with the outer faces of said overlying carpet portions to facilitate dispersal of static electricity, adjacent plates of the respective panels of said assembly being electrically coupled.

3. An assembly according to claim 2, wherein the flanges of adjacent plates lie in electrical contact one with the other.

4. An assembly according to claim 2 or 3, wherein each of a pair of said adjacent sheet metal plates lies in electrical contact with a part of said support structure whereby electrical contact between the carpet between said pair of plates is established through said support structure.

5. An assembly according to claim 4, wherein said support structure comprises a plurality of spaced pedestals, at least portions of one of said pedestals being electrically conductive and lying in electrical contact with the adjacent pair of plates.

6. An assembly according to any one of claims 2 to 5, wherein said support struc-

- ture comprises a plurality of spaced pedestals each carrying upstanding pins, said core and said plate having registering openings for receiving the upper ends of said pins. 25
- 5 7. An assembly according to claim 6, wherein said pedestals comprise wooden blocks.
- 10 8. An assembly according to claim 6, wherein said pedestals comprise inverted U-shaped members.
- 15 9. An assembly according to claim 6, wherein each of said pedestals is substantially cruciform in horizontal section.
- 20 10. An assembly according to any one of claims 2 to 4, wherein said support structure includes a plurality of spaced pedestals and a grid of metal stringers spacing said panels from said pedestals.
11. An assembly according to any one of claims 2 to 10, wherein said cores are made from pressed wood particle board, fibreboard, gypsum board, plywood, lightweight concrete, or lightweight concrete including metal reinforcing. 25
12. The floor panel substantially as hereinbefore described with reference to and as illustrated in Figures 10 to 17 of the accompanying Drawing.
13. The elevated floor assembly substantially as hereinbefore described with reference to and as illustrated in Figures 10 to 17 of the accompanying Drawing. 30
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FIG. 1

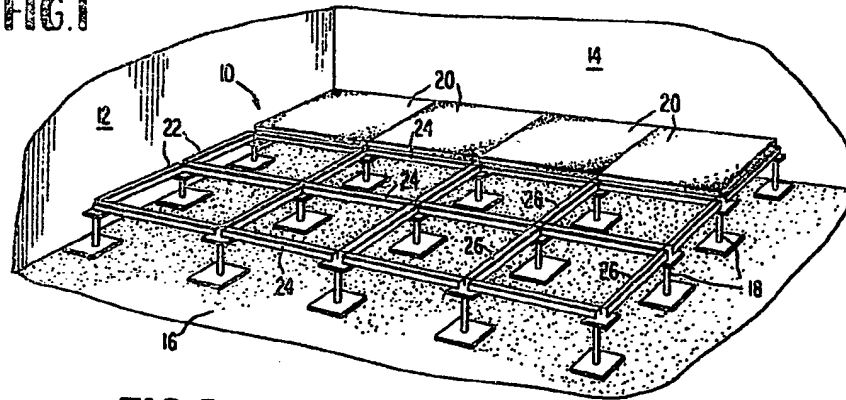


FIG. 2

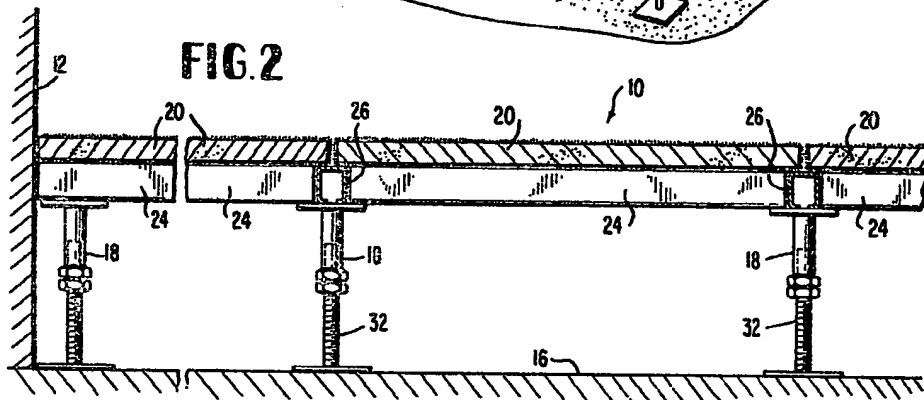


FIG. 4A

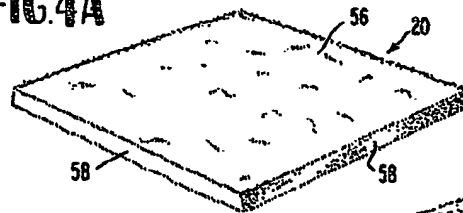


FIG. 4B

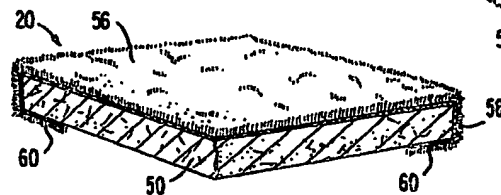
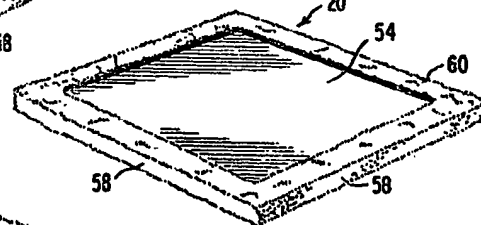


FIG. 5

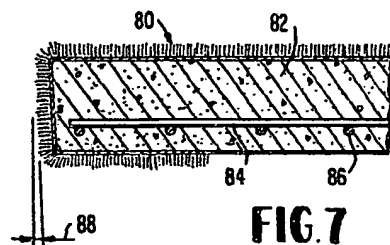
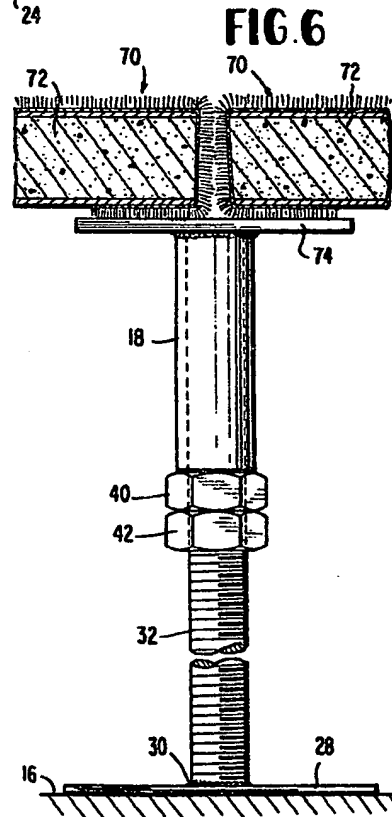
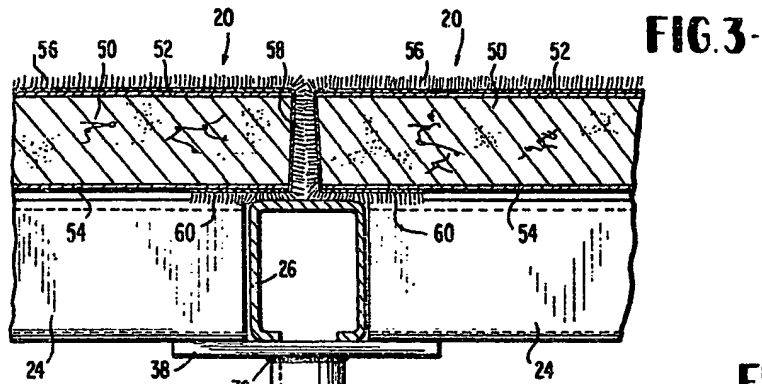


FIG. 8

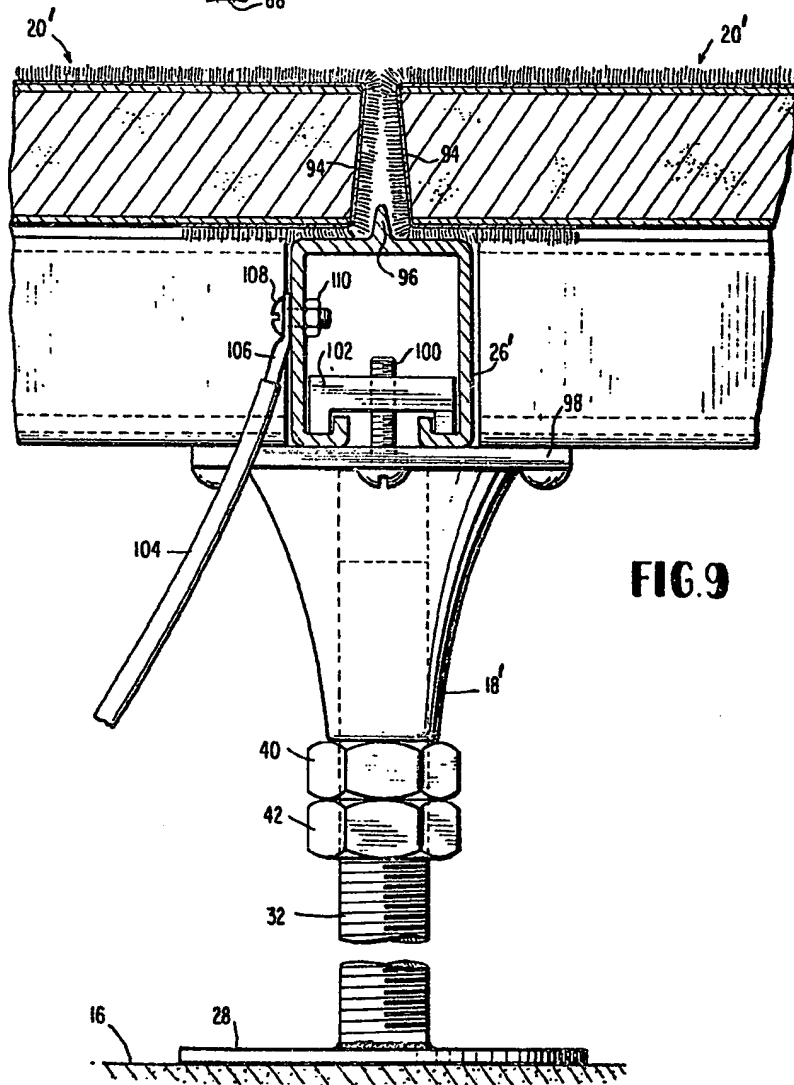
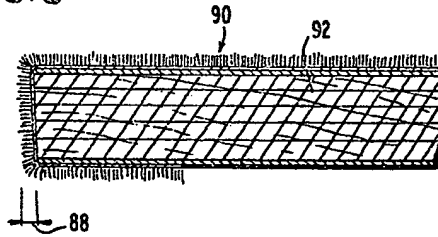


FIG. 9

